12/14/17 "What hurts more, the pain of hard work or the pain of regret?" -Unknown

HW: "Sketching Polynomials" #

Test 2 on Wednesday 12/20

AIM: How do we sketch polynomials without a graphing calculator?

Warm Up:

Given: find: (a) The complete factorization

$$f(x) = x^6 - 5x^4 - 36x^2$$

(b) The solution set

a) $x^2(x^4 - 5x^2 - 36)$

$x^2(x^2-9)(x^2+4)$

$\boxed{x^2(x-3)(x+3)(x^2+4)}$

$x=0$ | 3 | -3 | $x^2+4=0$

$-4 \quad -4$

$x^2 = -4$

$x = \pm\sqrt{-4}$

$x = \pm 2i$

b) $x = 0, -3, 3, \pm 2i$

No x term

$x^2 = x \quad x$

$x=0 \quad x=0$

Hw: Check

18) If 2 is a root then $x-2$ is a factor

$$\begin{array}{r} x^2 - 1x + 5 \\ x-2 \overline{\left) x^3 - 3x^2 + 7x - 10 \right.} \\ -(x^3 - 2x^2) \\ \hline -1x^2 + 7x \\ -(-1x^2 + 2x) \\ \hline 5x - 10 \\ -(5x - 10) \\ \hline 0 \end{array}$$

a) $\boxed{(x-2)(x^2-1x+5)}$

Not factorable

b) $x=2$

Use quad formula

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(5)}}{2}$$

$$x = \frac{1 \pm \sqrt{-19}}{2}$$

$$x = \frac{1 \pm i\sqrt{19}}{2}$$

20) 5 is a root $x-5$ is a factor

$$\begin{array}{r} x^2 + 6x + 9 \\ x-5 \overline{\left) x^3 + x^2 - 21x - 45 \right.} \\ -(x^3 - 5x^2) \\ \hline 6x^2 - 21x \\ -(6x^2 - 30x) \\ \hline 9x - 45 \\ -(9x - 45) \\ \hline 0 \end{array}$$

a) $(x-5)(x^2+6x+9)$

$\boxed{(x-5)(x+3)(x+3)}$

b) $x = 5, -3$

Sketching Polynomials

1) Find the zeros

2) Identify what the polynomial does @ each zero

   ex: cross, touch (bounce), terrace cross

3) Identify a point on the polynomial (* y-intercept is a great one) using calculator.

4) Sketch the polynomial starting at the point from step 3

* If a factor shows up <u>once</u> the polynomial crosses @ that zero.

<u>Ex:</u> $(x+5)$ crosses @ $x=-5$

* If a factor shows up an <u>even</u> number times then the polynomial will touch the x-axis @ that zero and stay on that side

<u>Ex:</u> $(x+5)^4$

Polynomial will touch (bounce) @ $x=-5$

* If a factor appears an <u>odd</u> number of times (more than once) the polynomial will cross @ that zero but "flatten" as it crosses.

<u>Ex</u> $(x+5)^{11}$ terrace cross @ $x=-5$

1) Sketch $P(x) = (x+2)^2 (x+5)$

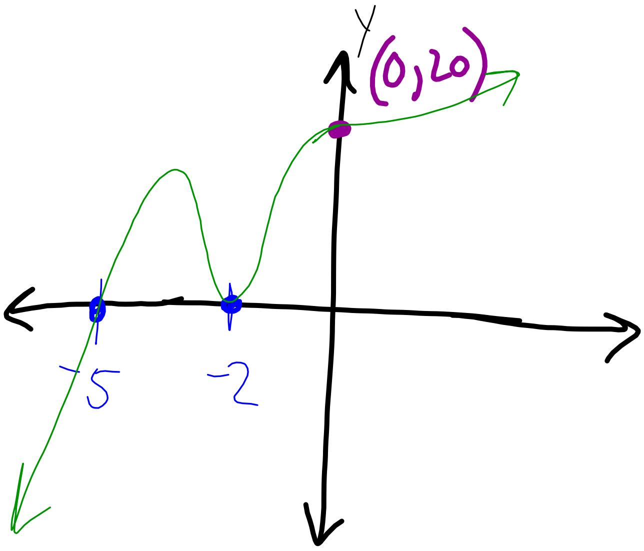
$x = -2$ bounce

$x = -5$ cross

x-value is always 0 @ y-int

$x = 0 \quad y = 20$

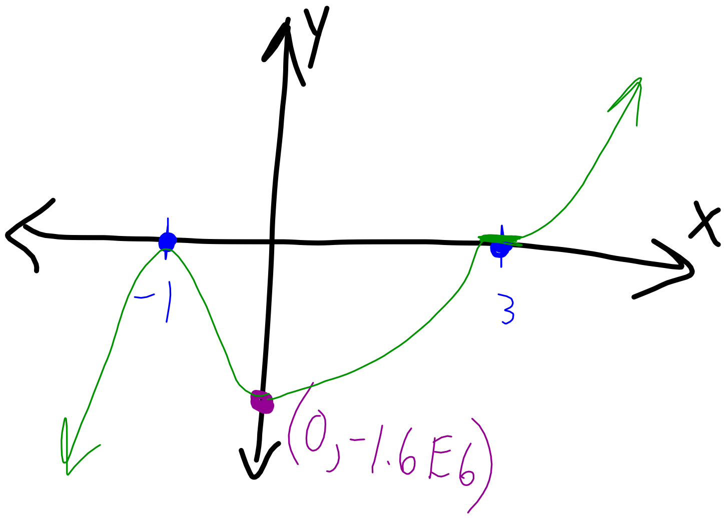
y-int $(0, 20)$



2) $P(x) = (x-3)^{13}(x+1)^{4}$ y-int: $(0, -1.6e^{6})$

$x = 3$ $x = -1$

terrace cross bounce



Sketch the general graph of each function without your graphing calculator. Your sketch should contain both the x- and y-intercepts.

1. $f(x) = (x + 1)(x - 2)(x - 4)$

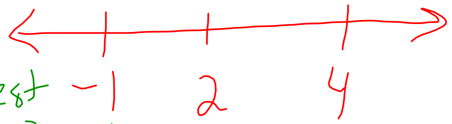
$x = -1, 2, 4$

Step 1: Find the zeros

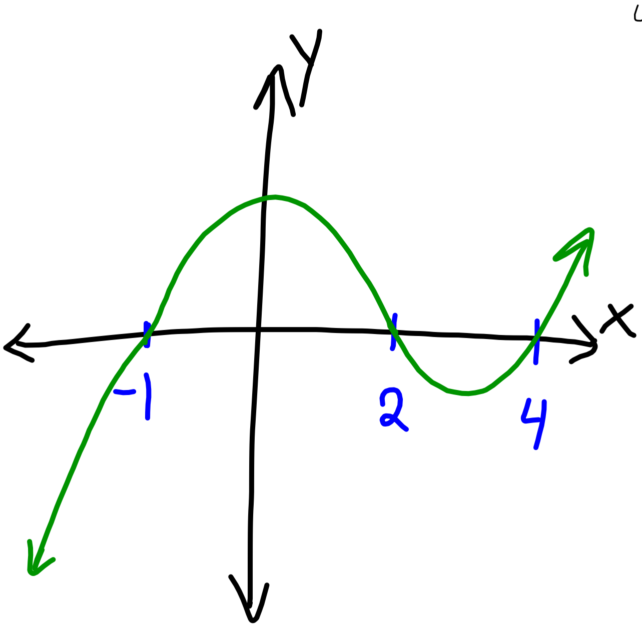
Step 2: Make a number line in order.

Step 3: Pick test values and plug them into the original. Record if it is positive or negative.

Step 4: Set up axes using the zeros as the x-intercepts. Graph the function below when Step 3 is negative and when step 3 is positive



Test	-2	0	3	5
	(-)(-)(-)	(+)(-)(-)	(+)(+)(-)	(+)(+)(+)
	−	+	−	+



2. $f(x) = -(x + 3)(x + 2)(x - 1)$

$$f(x) = x + 3$$

$$y = x + 3$$